GS 0426 A DIV I US

Manfred Rattunde
Gartenfeldstrasse 61
D-61350 Bad Homburg

Link-Plate Chain For Continuously Variable Conical Disc Transmission

The invention concerns a link-plate chain for a continuously variable conical disc transmission of the type described in the main claim.

Link-plate chains of this type are known, for instance by patents DE-35 26 062, DE-38 26 809 and DE-40 10 667. In these cases the retainer plate has the function of a frame, mainly serving to hold the chain link plates it contains, and to prevent separation of the chain. The rocker pins transmitting the friction force to the conical discs are secured against lateral motion from the link plate openings by energy beam welding. The problem of the retainer plate, the frame comprising the link plates, has been described in detail in patent DE-40 10 667, where it has been solved by the retainer plate frame not having a carrying function and being made of very thin titanium sheet metal.

Satisfactory results were obtained with this solution, there are important disadvantages however, for instance in acoustical optimation. To reduce the noise generated by the link-plate chain (rocker pin engagement shock) it is necessary to compose the entire chain length with at least two different pitches assembled in an aperiodic sequence. This means that retainer plate frames with at least two different pitches are needed as well, with the consequence of a costly production and assembly for a large-series production.

Leaving the retainer plate frame with its frame function out will not ensure a definite position of the link plates. The link plate can take an inclined position, peripherally as well as radially. The consequence would be that the link plate openings would not contact the rocker joint with their full thickness, but only with the edges.

The inclined link plates would be severely overloaded, thereby considerably reducing the tensile strength of the chain.

The energy beam securing measure per patent DE-35 26 062 is performed on the completely assembled chain. Experience has shown that it requires a thermal safety distance of about 1.5 mm from the outer link plates, as their texture would be damaged with a smaller distance, causing reduced strength. This thermal safety distance favors the link plate inclination, impairing the chain strength, and furthermore centering of the chain pull is not guaranteed.

The object of the invention is a link-plate chain of the type described above in which the retainer plates with their framing and holding function are completely omitted, without allowing link plate inclination impairing the chain strength, and guaranteeing centering of the chain pull. A further objective of the invention is the guarantee of a cost-effective large-series production of this link-plate chain.

The invention solves this problem by the characteristics of the main claim.

With the solution of the invention it is possible to entirely avoid the most problematic and most expensive component of the link-plate chain, the retainer plate. Up to now specialists considered this absolutely impossible. The measures of the invention provide a highly cost-effective production of the link-plate chain in large series. Furthermore acoustical optimation can be attained in essentially more simple and cost-effective ways. The characteristics of the invention guarantee centering of the chain pull, a must for high-performance transmissions.

Further characteristics and details are provided by the following description of implementations of the invention.

The drawings show:

Fig. 1 A top view section of the link plates in a three-plate connection Solution a

Fig. 2 Same as Fig. 1 Solution b

Fig. 3 A sectional view per Fig. 1 and 2 along sectional line I-I

Fig. 4 A top view section of the link plates in a two-plate connection Solution a

Fig. 5 A sectional view per Fig. 4 along sectional line II-II

Fig. 6 to 9 Various possible solutions for the mechanical stop of the outer link plate on the joint

Fig. 10 An example of a process sequence

The link-plate chains shown in fig. 1 to 3 are assembled in an arrangement called three-plate connection, those of fig. 4 and 5 in an arrangement called two-plate connection.
Fig. 1 shows solution a. The rocker joints 1 and 2 receive a mechanical stop 3 on one side prior to assembly, so positioned on the rocker joint that it is directly against the outer ladder 5 when the chain is completely assembled, thereby determining the total width of the link-plate chain. The rocker joints 1 and 2 thus prepared are alternately inserted from the left and the right into the link plate openings, as shown by an arrow in the drawing. Finally the energy beam fixation by a laser weld point 4 with a thermal safety distance C of about 1.5 mm from the outer lader 5 secures the chain against falling apart.

Fig. 2 shows solution b. The rocker joints 1 and 2 of a link with the tops prepared prior to assembly are alternately inserted by pairs from the left and the right into the link plate openings. After assembly the chain is secured by a laser weld point 4.

Fig. 3 corresponding to fig. 1 and 2 shows the fixation of the outer link plates 5 of the widest chain elements by the stops 3, as well

as the thermal safety distance C from the corresponding outer link 5.

Link-plate chain of Fig. 4 and 5 only differs from the chain shown in Fig. 1 to 3 as it is a chain in an arrangement called two-plate connection. Solution a, described above, is shown.

The figures 6 to 9 show various implementations of the mechanical outer link plate stop.

Fig. 6 Stop produced by a laser weld point, only on top

Fig. 7 Stop produced by a laser weld point, on top and on bottom

Fig. 8 Stop swaged, only on top

Fig. 9 Stop swaged, on top and on bottom

The laser weld points of the stops 3 in fig. 6 and 7 can be made prior to assembly, or on a pre-assembled chain, the rocker joints 1 and 2 only being inserted into the lader openings as far as to guarantee the thermal safety distance C. This last type can be favorable for large series production.

The swaged stops 3 in fig. 8 and 9 can be made prior to assembly, or on an assembled chain, using hard alloy tools.

Securing 4 against lateral motion of the rocker joints can be obained by swaging according to fig. 8 on the assembled chain.

Fig. 10 shows the process sequence in an example.
Step 1: The laser weld points 3 are made on the rocker joints outside of the link-plate chain or with the rocker joints in the link plate openings, but only inserted so far as to keep a distance from the outer link plate of at least the thermal safety distance C.
Step 2: Insertion of the rocker joints until the laser weld points 3 are in contact with the outer link plate.